"A New Method for Driving 128CH Matrix Phased Array Probes with a Very Compact and High Performance Solution"

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ABSTRACT

As phased array UT continues to gain wide acceptance, matrix arrays are also becoming more common and easily attainable, creating a need for higher channel count instruments. The Nuclear and Power Generation industry has been a major influential force in driving NDT technology to its limits to further improve inspection speeds, while dealing with complex geometry. This paper will explore how pairing matrix arrays with new phased array (PA) technology opens doors to better inspections. A high performance PA instrument with faster data rates, a smaller form factor, and capability to adapt to specific applications will also be highlighted. Also, new system integration techniques for demanding applications are discussed.

INTRODUCTION

Matrix Phased Array definitely brings benefits to the table in various non-destructive testing applications, but it is important to have proper equipment to drive the transducer while still staying cost effective. Some benefits of a matrix probe are being able to steer and focus the beam in a 3D volume, point focusing, faster scanning speeds and the ability to correct focusing aberrations. Having at least a 128/128 PA instrument like OEMPA gives the ability to fire and receive 128 elements at the same time improving beam steering and spatial resolution.

Figure 1 represents a size comparison to see that high channel instruments like a 64/64 and 128/128 are so compact compared to a typical notebook computer.

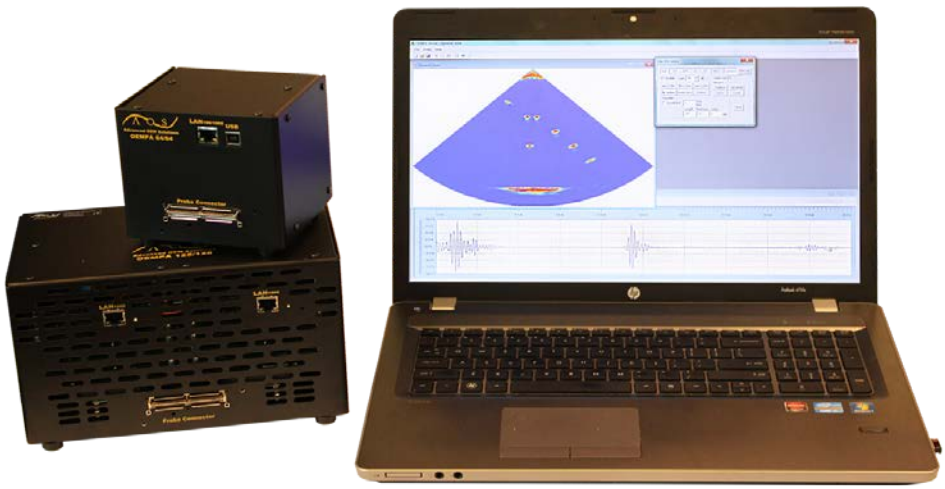

Figure 1: OEMPA 64/64 and OEMPA 128/128 with Laptop

UNIQUE BENEFITS OF OEMPA

OEMPA has many advanced features like excellent SNR, high parallel channel count instruments like 128/128, easy integration, fast data throughput, and more, however there are four benefits that make OEMPA even more unique.

- Size – Having a smaller size instrument opens the door to mounting the instrument anywhere and easier integration into automated systems.
- Openness – This provides research institutes, universities and integrators the opportunity to control the instrument in a flexible way.
- Cost Effective – Everyone loves new state of the art technology, but in a practical sense OEMPA's low price point allows easier adoption.
- OEM – Integrators can take advantage of an OEM model to save cost on research and development costs of a new instrument and concentrate on the final software application and final solution.

MATRIX ARRAY 3D FOCAL LAW CALCULATOR

Driving a matrix probe is not so trivial. The required delays that make up the focal laws is different and more complex than doing an electronic scan or sector scan with a linear phased array transducer. With the software development kit for OEMPA one can call software functions to input information like the probe parameters, wedge parameters and sweep parameters to setup the instrument. Often it is necessary to visualize what one input into the calculator to verify if that is where one would expect the beam to cover in the material.

Typically, with a linear array or a rectangle array element pitch can be defined by specifying the element spacing by a pitch in the primary axis and secondary axis. However, in the case of the Rho Theta probe you would require a custom element mapping where the X, Y coordinate for each element is input into the calculator. The software actually even supports an extra Z coordinate as well.

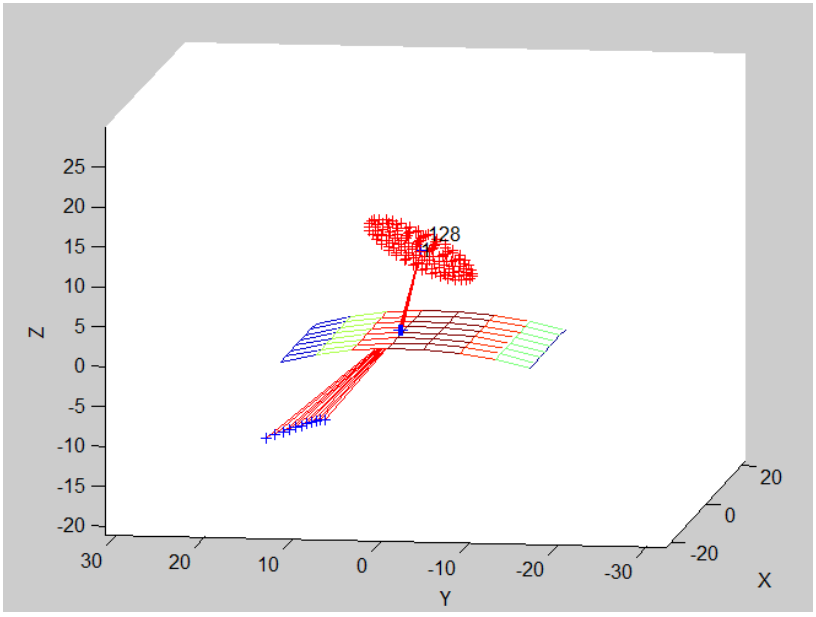

Figure 2: Rho-Theta Probe on a Curved Surface (e.g. Pipe)

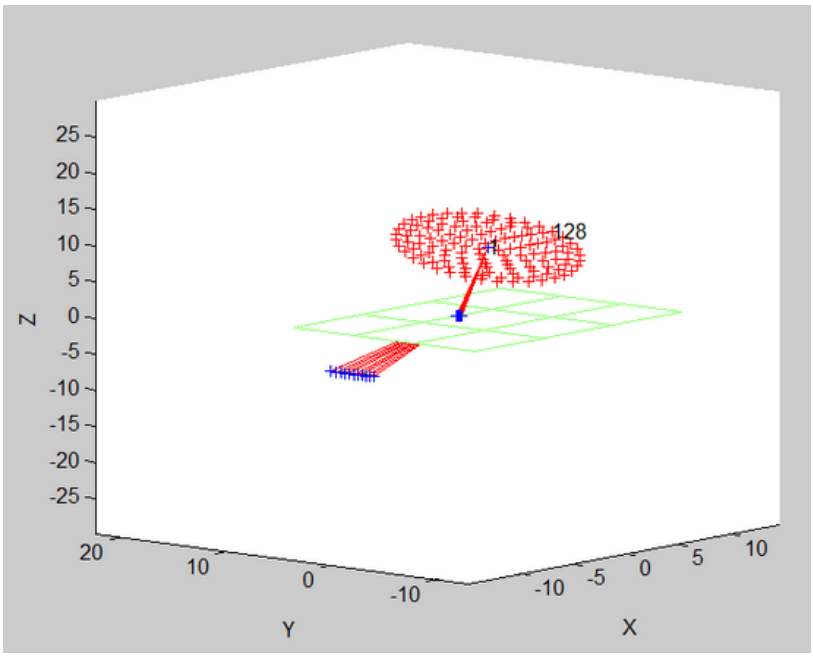

Figure 3: Rho-Theta on a Plane Surface

SMALL FORM FACTOR

Traditional systems for nuclear pressure vessel weld inspections require extremely long umbilical cables that can go upwards of 50 meters that mainly consist of separate coaxial cables for each phased array channel. It is well known that phased array has a large number of channels, in some cases as many as 128 or more. One can already imagine the thickness and diameter of such a cable. It is also important to consider the weight and the ease of handling. What happens when one of these cables fails or is damaged? Inspectors need to have spare cables readily available. When you add the cost of this complex cable with spares it can in some cases equal or exceed the cost of the phased array instrument itself.

Figure 4: OEMPA 64/64 Can Be Held in One's Hand

CONCLUSION

Matrix phased array will continue to grow in popularity as its benefits are understood, cost effectively implemented or adopted in procedures. Having the right instrument to drive the transducer is crucial in a successful inspection system. OEMPA demonstrates advanced capabilities like a focal law calculator powerful enough to generate delays for various types of matrix probes (custom mappings, rectangular mappings and linear), compact size for easier integration and mounting closer to the transducer, low price point, OEM concept of freedom in branding, and openness in full control and access to the low level parameters.

REFERENCES

1) Dao G and Ginzel R, “New Customizable Phased Array UT Instrument Opens Door for Furthering Research and Better Industrial Implementation”, The 40th Annual Review of Progress in Quantitative Nondestructive Evaluation, 2013.